

AMENDMENT UNDER 37 C.F.R. § 1.111
Appln. No. 10/039,333

PATENT APPLICATION

IN THE CLAIMS:

The following listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1. (Currently Amended) A method of anisotropically etching a layer ~~containing~~ of substantially pure tungsten, the layer being disposed on a substrate and having a patterned hard mask layer disposed thereon, the method comprising:

placing the substrate in a plasma zone;

introducing into the plasma zone a process gas mix comprising NF_3 and Cl_2 ; and

forming a plasma from the process gas mix to etch the ~~tungsten-containing~~ layer of substantially pure tungsten substantially anisotropically and at an etch rate greater than the rate at which the hard mask layer is etched.

2. (Currently Amended) The method of claim 1, wherein the layer of substantially pure tungsten ~~containing layer~~ is etched at an etch rate at least twice the rate at which the hard mask layer is etched.

3. (Currently Amended) The method of claim 1, wherein the layer of substantially pure tungsten ~~containing layer~~ is etched at an etch rate that is about 2.5 greater than the rate at which

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the hard mask layer is etched.

4. (Original) The method of claim 1, wherein the process gas mix is introduced with a volumetric flow ratio of NF_3 and Cl_2 that is selected to provide etched features having a critical dimension loss of less than 4% and having sidewalls that form angles of at least about 88 degrees with a surface of the substrate.

5. (Original) The method of claim 1, wherein the gas mix is introduced with a volumetric flow ratio of $\text{NF}_3 : \text{Cl}_2$ is in the range of from about 1:1 to about 1:2.5.

6. (Original) The method of claim 1, wherein the gas mix is introduced with a volumetric flow ratio of $\text{NF}_3 : \text{Cl}_2$ is in the range of from about 1:1.3 to about 1:2

7. (Original) The method of claim 1, wherein the process gas mix consists essentially of NF_3 and Cl_2 .

8. (Original) The method of claim 1, wherein the process gas mix further comprises a passivator gas.

9. (Original) The method of claim 1, wherein the hard mask layer comprises silicon nitride.

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10. (Currently Amended) A method of etching a ~~tungsten~~
~~containing layer of substantially pure tungsten~~ that is covered
with a patterned hard mask layer and disposed on a substrate,
using a process chamber that has process electrodes therein and
an inductor coil adjacent to the process chamber, the method
comprising:

placing the substrate on which the ~~tungsten-containing~~ layer
of substantially pure tungsten is disposed into the process
chamber;

introducing into the process chamber, a process gas mix
comprising NF_3 and Cl_2 ; and

ionizing the process gas mix to form plasma ions that
energetically impinge on the ~~tungsten-containing~~ layer of
substantially pure tungsten and the hard mask layer by applying
RF energy to the inductor coil and applying RF energy the process
electrodes,

wherein the ~~tungsten-containing~~ layer of substantially pure
tungsten is substantially anisotropically etched at an etch rate
greater than the rate at which the hard mask layer is etched.

11. (Currently Amended) The method of claim 10, wherein the
layer of substantially pure tungsten ~~containing layer~~ is etched
at an etch rate at least twice the rate at which the hard mask
layer is etched.

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12. (Currently Amended) The method of claim 10, wherein the layer of substantially pure tungsten ~~containing layer~~ is etched at an etch rate that is about 2.5 greater than the rate at which the hard mask layer is etched.

13. (Original) The method of claim 10, wherein the process gas mix is introduced with a volumetric flow ratio of NF_3 and Cl_2 that is selected to provide etched features having a critical dimension loss of less than 4% and having sidewalls that form angles of at least about 88 degrees with a surface of the substrate.

14. (Original) The method of claim 10, wherein the volumetric flow ratio of NF_3 : Cl_2 is from about 1:1 to about 1:2.5.

15. (Original) The method of claim 10, wherein the volumetric flow ratio of NF_3 : Cl_2 is from about 1:1.3 to about 1:2.

16. (Original) The method of claim 10, wherein the volumetric flow ratio of NF_3 : Cl_2 is from about 1:1 to about 2:1.

17. (Original) The method of claim 10, wherein the volumetric flow ratio of NF_3 : Cl_2 is from about 1.3:1 to about

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2:1.

18. (Original) The method of claim 10, wherein the process gas mix consists essentially of NF_3 and Cl_2 .

19. (Currently Amended) A method of etching a ~~tungsten~~ containing layer of substantially pure tungsten that is covered with a patterned hard mask layer and disposed on a substrate, using a process chamber that has process electrodes therein and an inductor coil adjacent to the process chamber, the method comprising:

placing the substrate on which the ~~tungsten-containing~~ layer of substantially pure tungsten is disposed into the process chamber;

introducing into the process chamber, a main etch process gas mix comprising NF_3 and Cl_2 ;

ionizing the main etch process gas mix to form plasma ions that energetically impinge on the ~~tungsten-containing~~ layer of substantially pure tungsten and the hard mask layer by applying RF energy to the inductor coil and applying RF energy the process electrodes, wherein the ~~tungsten-containing~~ layer of substantially pure tungsten is substantially anisotropically etched at a main etch rate greater than the rate at which the hard mask layer is etched;

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introducing into the process chamber, an over etch process gas mix comprising Ar and Cl₂ ; and

ionizing the over etch process gas mix to form plasma ions that energetically impinge on the ~~tungsten-containing~~ layer of substantially pure tungsten and the hard mask layer by applying RF energy to the inductor coil and applying RF energy the process electrodes, wherein any remaining portion of the ~~tungsten containing~~ layer of substantially pure tungsten that is not masked by the hard mask layer is substantially anisotropically etched away.

20. (Currently Amended) The method of claim 19, wherein the layer of substantially pure tungsten ~~containing-layer~~ is etched at a main etch rate at least twice the rate at which the hard mask layer is etched.

21. (Currently Amended) The method of claim 19, wherein the layer of substantially pure tungsten ~~containing-layer~~ is etched at a main etch rate that is about 2.5 greater than the rate at which the hard mask layer is etched.